Misc. pam. 63
OCLC: 1109677

A 000 550 149 9
UC SOUTHERN REGIONAL LIBRARY FACILITY

FOR OFFICIAL USE ONLY

GENERAL NOTES ON THE USE OF ARTILLERY

TRANSLATED AND EDITED AT THE ARMY WAR COLLEGE

NOVEMBER, 1917

UNIVERSITY OF CALIFORNIA AT LOS ANGELES
MAR 28 1934
LIBRARY

California Regional Facility

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

WAR DEPARTMENT.

Document No. 696.

Office of The Adjutant General.

WAR DEPARTMENT,

WASHINGTON, *November 12, 1917.*

The following pamphlet "General Notes on the Use of Artillery" is published for the information of all concerned.

[062.1, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

JOHN BIDDLE,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

TABLE OF CONTENTS.

PART I.

	Page.
Preface	7
Organization of the command	7
General commanding the artillery of the army	7
General commanding the artillery of the corps	8
Colonel commanding the divisional artillery	8
Missions	9
Artillery information service	11
Observation	12
Liaison	13

PART II.

Execution of Missions.

Counter-action battery	14
Destruction	14
Neutralization	15
Fire on enemy fieldworks	16
General remarks	16
Wire entanglements	16
Chevaux de frise	17
Shelters	17
Trenches	17
Permanent fortifications	17
Towns and villages	18
Railways	18
Maintenance of the demolition	18
Fire on lines of communication	19
Fire with gas shells	19

PART III.

Page.
The artillery during the execution of the attack..... 21
By counter-battery fire..... 21
By accompanying fire..... 21
By general covering fire..... 21
By box barrage..... 22
By fire on command posts and observation stations..... 22
By fire on lines of communication..... 22
By fire against counter attacks..... 22
By movements of batteries..... 23
By fire against attempted enemy counter offensive..... 23

PART IV.

Special Defense Fire.

Offensive counter preparation..... 24
For the field artillery..... 24
For the high-angle-fire artillery..... 25
For the long-range artillery..... 25
Barrage..... 25
Field artillery barrage..... 25
Front..... 25
Targets..... 25
Density of fire..... 26
Opening of barrage fire..... 26
Preparation for the barrage..... 27
Contingent fire..... 27
Harassing fire..... 27
Fire in reprisal..... 28
Concentrations of fire..... 28

PART V.

Preparation of the Work of the Artillery.

PLANS OF ACTION. Page.

The offensive 30
First rôle of the artillery 30
Exploitation of success 33
Tactical exploitation 33
Strategic exploitation 34
Plan of action of the artillery 35
Employment of the aviation service 37
The defensive 37
Plan of the employment of the artillery 37
Plan for the contingent reenforcement of the sector 38
Appendix I.—Safety-zone tables 39
Appendix II.—Other tables 42
Appendix III.—Preparation of ground for an attack 46

GENERAL NOTES ON THE USE OF ARTILLERY.

PART ONE.

PREFACE.

The purpose of the following discussion is an exposition of the current ideas with regard to the use of artillery in war. All its contents are drawn from the current regulations and from notes issued by general headquarters or by the artillery instruction center.

It must not be thought that the use of artillery is something immutable; it varies not only with circumstances but with lapse of time, as new matériel is brought into service and require appropriate use.

ORGANIZATION OF THE COMMAND.

Functions of the various grades of command.

The following publications determine these functions:

"Regulations on the Conduct of Higher Units."

"Provisional Regulations for Field Artillery."

"Instruction on Higher Units in Offensive Combat."

"Notes on the Use of the Heavy Artillery and the High-Powered Heavy Artillery."

"Note on the Use of Artillery on the Defensive."

THE GENERAL COMMANDING THE ARTILLERY OF THE ARMY.

He distributes the artillery among the Army corps and exercises a direct control over its use as representative of the Army commander. *He has under his direct command the long-range pieces (the high-powered heavy artillery 100's, 105's, 14's, 16's, 155's, 240's, 270's, 280's, 370's, etc., and also the railway heavy artillery) of the Army, and, contingently, the groups of heavy artillery*, the use of which the general commanding the Army has reserved to himself for the special missions which concern the sectors of several corps.

THE GENERAL COMMANDING THE ARTILLERY OF THE ARMY CORPS.

He exercises, as representative of the general commanding the Army corps, a direct control over all the artillery of the Army corps. He has under his command the batteries kept at the disposal of the Army corps (field and heavy artillery); generally *the medium caliber heavy artillery (125's, 120's, and contingently 155's and 105's) and also certain batteries of large caliber heavy artillery howitzers;* when necessary he arranges to put part of the corps artillery at the disposal of the divisions.

THE COLONEL COMMANDING THE DIVISIONAL ARTILLERY.

He exercises command over the artillery belonging to the division and also over units from any source which have been put at the disposal of the sector held by the division, i. e., trench artillery, batteries of heavy artillery using curved fire (155 howitzers and sometimes 220's), and battalions of corps artillery put at his disposal by the Army commander.

There is nothing absolute about this distribution, and it is modified according to circumstances. Above all, it must not lead to independent action by the artillery occupying the sectors of the division, the Army corps, and the Army. It is indispensable that, in case of need, all batteries capable of acting on the threatened front should be able to intervene regardless of the command to which they belong and of the commander from whom they take their orders.

The mechanism for this intervention is explained in the discussion of concentration of fire. The measures to be taken to facilitate this intervention should be foreseen and studied in detail in each unit, and should be the subject of a special chapter on the plan of use of artillery.

In particular, the heavy artillery of the Army corps should be organized to play the rôle of attentive servant of the divisions; that is, to anticipate their wants and be ready to satisfy them instantaneously. This applies equally to the heavy artillery with relation to the Army corps.

The organic constitution of the artillery of the different units is designed to meet the requirements of open warfare and avoid the necessity of improvising at a moment of crisis.

As a rule, the artillery of the Army, when given as reenforcement to an Army corps, is attached to the corps artillery. Part or all of the corps artillery, including reenforcements, may be used to reenforce the divisional artillery.

Nevertheless, in forming temporary artillery commands, the organic constitution of the units should be respected as far as possible, and battalions should be broken up only exceptionally.

One authority should not have under his direct orders more than three of four subordinate units.

When any artillery is reenforced, its commander takes command of all the reenforcements. The commanders of the reenforcement are given command of intermediate units, if this is consistent with their rank, otherwise they are left unattached and may be used later as relief commanders.

When pieces of different types are at the disposition of the Army corps artillery, it is often advisable to form commands with battalions of different calibers.

On the offensive, when numerous trench-artillery pieces are put in action, it is advisable to distribute the different batteries of trench artillery among the commands or battalions of 75's. This affords more supple control than is possible if one commander has under his authority units arranged side by side on a line along which communication between the units is difficult; the field artillery can more easily supplement the destruction of auxiliary defenses accomplished by the trench artillery; and, finally, the trench artillery is reenforced with means of observation (especially with airplanes, which it does not have at its own disposal).

MISSIONS.

In each higher unit the commander designates the *normal zone of action* of its artillery, in which it is in charge of all targets which are presented, whatever their nature.

This, however, is not enough to secure the maximum results from the arm, for it neglects the valuable effects of enfilade fire, of concentration of fire, and of the utilization of the power of certain pieces to the full limit of their range. It is therefore necessary to provide for the intervention of the different artillery units not only in their own zone of action but in the neighboring zones as well.

The artillery commander has two means of effecting this intervention: *Direct command* and *coordination.*

The fire of an artillery in its normal zone of action is opened by the authority which has direct command of it.

By coordination, a commander makes his subordinate artillery intervene in the normal zone of his neighbor, or reinforce him. The zone in which an artillery can thus intervene outside its normal zone of action is its *contingent zone of action.*

The latter zone may therefore extend to the limits of possible action. It is advisable, however, when defining the normal zone of action of each unit, to specify the regions in which its intervention will most frequently be required. The total of these regions will form what is properly known as the contingent zone in which preparations for fire and the adjustments with a view to assuring rapid opening of fire under favorable conditions will be made.

Coordination is exercised as much in providing for the reciprocal support which the artillery units can give one another as in calling for intervention in the moment of need. That is to say, coordination makes itself felt *in preparation* as well as *in execution.*

On the defensive, in the period of stabilization, and on the offensive which follows that period, coordination is exercised particularly in the preparation; in making and reconciling plans for the use of the different units; in preparing written orders and providing appropriate lateral liaisons.

In open warfare, on the contrary, coordination is exercised principally in the execution.

The general commanding the Army corps has at his disposal the corps artillery. It is the duty of the commander of this artillery to keep constantly informed of the needs of the divisions in order to advise the corps commander of the points where this force is required and, when necessary, to call for the intervention of the artillery of a division on the front of a neighboring division.

For this purpose the commander of the artillery of the Army corps should always know *what each unit of artillery is doing, what are its possibilities, and what are its needs.* But, in order to have the coordination effective at the moment of need, it is indispensable that this information reach him with the least delay. To secure this, reports on the three points above mentioned are sent direct to him by the commanders of the divisional artillery in the form of planimetric sketches on which a red line is drawn around the zones which these units can cover, and a blue line around those in which their fire needs support.

The general commanding the artillery of the Army follows the same procedure with the different Army corps; but as the Army, in general, keeps no artillery under its direct orders, his action is limited to ordering the intervention of the batteries of one Army corps on the fronts of the neighboring Army corps.

ARTILLERY INFORMATION SERVICE.

The function of this service is to supply, as rapidly as possible, precise information on *the enemy batteries* (the positions they occupy, their targets, degree of activity, and, if possible, the number of pieces and their degree of protection), and *the enemy organizations* (defensive and offensive fieldworks, observation stations, telephone lines, railways, tracks, bivouacs, munitions and matériel depots, etc.).

The artillery information service has at its disposal the following sources of information: Terrestrial observation stations of the artillery and of the headquarters, sections for research of information by terrestrial observation, sound location sections, aerial observation and photographs, information received from the adjoining corps and from the intelligence section of the staff.

In addition, all information on the enemy artillery gathered by the infantry and artillery troops should be communicated to the artillery information service.

In case of urgency the information collected is communicated to the executives by telephone, taking all necessary precautions to avoid indiscretions, and in all cases by a daily bulletin covering 24 hours and distributed to all officers down to and including battery commanders.

The artillery information service also makes a map on the scale of 1/10.000, on which are entered: The enemy batteries, their caliber, targets, and degree of activity; all new information on enemy targets.

Finally, descriptive cards of the enemy batteries are kept embodying the latest information, and including, notably, the photographic study of the position. They serve as the basis of counter-battery fire, and especially of fire for destruction. These cards are communicated to the balloon and airplane observers and to the commanders of artillery commands, battalions, and batteries interested.

OBSERVATION.

This subject has been thoroughly treated in the courses of instruction and in the field. The discussion here will be only a short statement of general principles.

First. The purpose of artillery observation is:

(*a*) The surveillance of the enemy sector (batteries, fieldworks, movements).

(*b*) The adjustment and control of fire.

Its proper operation is of capital importance for the artillery; an artillery without observation is *blind and useless.*

Second. Its organization rests on two principles, namely:

(*a*) The command of fire and the observation of fire are independent tasks.

(*b*) The system of observation is arranged to correspond to the targets, and not to the positions of the batteries which execute the fire.

Third. The means of observation at the disposal of the artillery are terrestrial observation stations, balloons, and airplanes.

The advantages of terrestrial observation are its permanence, the possibility of using perfected sighting instruments, and its comparative independence of weather conditions.

The airplane affords rapid, precise, and, when necessary, vertical observation on the most distant and most defiladed targets.

The balloon is a very elevated observation station which has the advantages over the airplane of continuity of observation and immediate and direct transmission of information; on the other hand, its field of observation is limited and its line of sight oblique.

Finally, the use of aerial observation is largely limited by atmospheric conditions.

In open warfare observation is effected in accordance with the same principles, so far as circumstances allow.

A particular essential is a complete understanding among the airplane squadrons of the means of entering into communication with the command posts of artillery battalions, commands, etc. As telephone communication between the squadrons and the command posts is impossible, the proper utilization of the aviation service will depend entirely on this understanding being reached in advance, and on the perfect utilization of the means of communication from the ground to the airplane.

LIAISONS.

Mere mention will be made of the means employed. They are principally: The telephone and wireless telegraphy, reinforced by the following auxiliary liaisons (which will be in general the only ones which can be used by troops in the first line), *visual signals, rockets, liaison agents, runners, carrier pigeons, sound signals* (*trumpets*), *earth-conduction telegraphy.*

In open warfare, wireless telegraphy can afford communication between the principal command posts and the airplane squadrons pending the construction of telephone lines.

Similarly, on the offensive and in open warfare, an indirect liaison between the infantry and the artillery can be obtained through the infantry airplane. A beginning has also been made of the use of visual and sound signals from the airplane to the ground for the infantry airplane and the adjustment of trench mortars.

An artillery officer is posted near each infantry colonel (commanding a subsector). This officer has under his orders *a liaison and observation detachment*, comprising observers (N. C. O.'s), liaison agents, telephone men, and signalmen.

PART TWO.

THE EXECUTION OF MISSIONS.

COUNTER-BATTERY ACTION.

Counter-battery action is the essential mission of the artillery, as the enemy gun is the most redoubtable adversary. As a general principle, counter-battery action is effected by destruction; when this is impossible, recourse is had, as a last resort, to neutralization.

DESTRUCTION.

Destruction is sought whenever time and means are available. It involves adjustment on each piece of the target and continuous observation or frequent verification of the fire for effect. This fire is interrupted only when the desired results have been obtained.

The following table suggests the consumption of ammunition to be anticipated for the destruction of an enemy battery:

	Rounds.
75 mm.–90 mm	1,000
95 mm.–120 mm	900
155 mm	600
155 mm. howitzer	500
220 mm.–270 mm	330
280 mm.–19 mm.–24 mm.–240 mm	250–300
Larger calibers of high-powered heavy artillery	100

These are average figures, which vary with the degree of perfection of the fire and of the observation, with the situation and with the strength of the target.

In a general way howitzers and mortars are to be used on strongly protected targets, for their crushing effect, and on targets which are on steep inclines, since the dispersion from their plunging trajectory is increased by the slope of the ground.

Destruction should be executed in the least possible time, in order to avoid poor adjustment due to atmospheric variations and to get the maximum result from aerial observation. It is therefore advisable to use rapid-fire pieces for this purpose when concentration of fire is not used instead; that is to say, to

employ two connected batteries (battalion) to carry on a fire of destruction on an enemy battery. (Note.) The adjustment is done at the same time but separately for each battery of four pieces; then the fire for effect carried out by salvos of eight rounds from both batteries at the request of the airplane can be rapidly done and well observed.)

If means of observation are lacking, destruction can be effected by zone fire, but this requires the expenditure of four or five times as much ammunition. Nevertheless, great destruction can be expected against clusters of battery positions known to be occupied and forming a mass of artillery in a well-defined and restricted area. A daily program of destructions is issued by the Army corps and is constantly corrected to embody the latest information from the artillery information service.

Fire in the normal zone of action of a battalion is opened on the initiative of the battalion commander, under the conditions fixed by the plan of action. The intervention of a unit in its contingent zone of action is determined by the commander of the higher unit, who has under his orders both the intervening unit and the normal zone of action in which the fire is to be effected.

When an offensive action is decided, the destruction of the enemy batteries is undertaken as long in advance as possible. The work is pursued during the course of the artillery preparation and is suspended at the moment of the attack only if the necessity of neutralizing simultaneously all the enemy artillery requires that every available battery be devoted to this purpose. It is well, however, to reserve some units to open fire on batteries which may disclose themselves unexpectedly, or which may not have been included in the program of neutralization.

NEUTRALIZATION.

When time, means, and precise data on the targets are lacking, recourse is had to *neutralization*, which is a fire giving only *momentary effects*. It interferes with the service of the enemy batteries and even puts him out of action occasionally. When there is a lack of precise data concerning the target, the density of fire is reduced in order to cover an extended area. All types of pieces may be employed, but preferably those capable of rapid fire. We fire by irregular volleys to hold the enemy under the threat of a resumption of fire.

For long ranges the 105 mm. can be used to advantage, instead of the 155 mm.

We use shell (sometimes shrapnel or case-bursting shrapnel) and *special shell*, but when the latter are used the fire should be continuous in order to prolong the threat of asphyxiating effects, which oblige the enemy to wear their masks continually and thus greatly reduce their freedom of movement. Neutralization of the batteries must be completed by an artillery action against the ground observing stations so that they can not be used while the airplanes are attacking the adjusting balloons and airplanes of the enemy.

FIRE ON ENEMY FIELD WORKS.

GENERAL REMARKS.

Fire on enemy field works is precise fire and should not be undertaken except when conditions are favorable—good weather, ranges from one-half to three-fourths the maximum range for the charge and shell employed, perfect observation, and very close adjustment.

Only when no means of observation are available should we use zone fire. The effects then obtained are incomparably less. Under these circumstances, the best procedure is to use short transfers of fire, preceded by careful adjustment on auxiliary targets not far from the targets to be demolished.

Use great care in choosing the piece to employ the type of projectile, the kind of fuse, and its priming. Fire at each target the number of rounds experience has shown to be necessary.

Invariable rule.—All fire for demolition should be controlled not only by observers or reconnaissances in which the artillery and the infantry are represented, but also by the examination of aerial photographs.

The time necessary for demolition varies from one to five or six days, according to the number and importance of the works to be destroyed, the number of guns, and the means of observation available.

WIRE ENTANGLEMENTS.

We open breaches at least 25 meters wide (in order not to break the momentum of the assaulting waves), spaced at less than 100-meter intervals between the center lines of the breaches. We avoid firing by single piece. We fire all pieces of a battery or with several trench mortars at a time.

(*a*) *At short ranges.*—We use trench artillery, 58 mm. No. 2 guns, and Van Deurens.

(*b*) *At medium ranges.*—We use the 75 mm. If the entanglement is on too steep a slope to be reached by flat-trajectory guns, we use the 120-mm. Schneider and the 155-mm. howitzer.

(*c*) *At longer ranges.*—At about 6,000 meters we use the 120-mm., the 155-mm., or the 155-mm. Schneider howitzer, with instantaneous fuse explosive shells.

CHEVAUX-DE-FRISE.—The same rules as above. We use projectiles with delayed-action fuses, the burst of which will disperse these obstructions. The number of projectiles to be employed is the same as that necessary to destroy a wire entanglement of average depth. (See table I.)

SHELTERS.—Fire should be continued until two hits on the target have been clearly observed. Machine-gun shelters and observation stations can be put out of action by embrasure hits, using the 75 mm. Strongly casemated shelters are generally demolished by crushing; at short ranges trench artillery should be used for this. Beyond 2,000 meters we use the 155-mm. howitzer, the 220 mm., the 270 mm., or the 280 mm. with delayed action fuses. (See Table II for the number of projectiles to use.)

TRENCHES.

We do not undertake continuous demolition, but choose a system of important points (junctions of communication trenches, salients, etc.) at intervals of 30 to 50 meters, depending on the obliquity of the fire. We proceed with fire adjusted on these various points, and the dispersion will take care of the rest. We use projectiles with delayed-action fuses. We use, preferably:

At short ranges.—Trench mortar, 58 mm. No. 2 and Van Deurens.

At medium ranges.—(About 3,000 meters) the 155-mm. howitzer.

At ranges of about 6,000 meters.—The 155-mm. gun and the 155-mm. Schneider howitzer.

The 75 mm. gives good results only on approach trenches, which it can take in enfilade, principally at long ranges (from 5,000 to 7,000 meters), its angle of fall giving it good penetration.

(See Table III for the number of projectiles to use.)

PERMANENT FORTIFICATION WORKS.

The various concrete portions of the works are taken under fire separately by the large caliber howitzers and mortars (293 mm., 370 mm., 400 mm.) firing armor-piercing shells with de-

layed-action base fuses at ranges not exceeding ¾ the maximum, trying to hit the unsupported portions and to fill up the excavation. For the earthworks and superstructures we use the 155-mm. gun or the 155-mm. howitzer with delayed-action fuses. (See Table IV for the number of projectiles.)

TOWNS AND VILLAGES.

Demolition of towns comprises:

(*a*) *Crushing vaults and cellars.*—We use large caliber howitzers and mortars, delayed-action fuses.

(*b*) *Demolishing and burning the houses.*—We alternate fire of melinite shells (155-mm. howitzer or gun, 220 mm. and 270 mm. mortars, delayed-action fuses) and of incendiary shells (155 mm.) fired with fuses timed to burst low. We begin with a light shell fire, continue with incendiary shells, and finish with melinite shells.

(*c*) *Demolition of special works constructed by the enemy.*—These works (trenches, communication trenches, shelters, etc.) are ruined as described above for the demolition of the trenches and shelters of the various positions.

(*d*) *The streets are made impassable* by a fire of small and large caliber shells with time fuses (75 mm., 90 mm., 95 mm., and 120 mm.). (See Table V for the number of shells to use.)

RAILWAYS.

The particularly important points to demolish are railway constructions, such as bridges, culverts, tunnel mouths, fills, and certain points at stations (water tanks, switch-control systems, etc.). As far as possible these are taken under enfilade fire with medium or large caliber guns (155 mm., 240 mm., 320 mm.) or howitzers (220 mm., 270 mm., 280 mm., 370 mm.), using elongated shells with delayed-action fuses. Fire is continued until 2, 3, 4, or 5 hits are clearly observed on the target. In very many cases it will be preferable simply to make the railway impassable by an irregular fire with small or medium caliber time-fuse shrapnel or explosive shell. (See Table VI for the number of projectiles to use.)

MAINTENANCE OF THE DEMOLITIONS.

It is indispensable to prevent the enemy from proceeding with any repair work during the night (when adjustment of fire is

necessarily interrupted), or during either day or night in the case of demolitions completed before the *attack*. For this purpose we cover the whole front of the target systematically by irregular volleys. We use the small and medium calibers (75 mm., 90 mm., 95 mm., 120 mm.), either percussion fire with instantaneous fuses or time-fuse fire (shrapnel or shell).

We figure on a consumption of 100 to 150 projectiles per night for every 200 meters of front to be covered.

FIRE ON LINES OF COMMUNICATION.

This fire gives satisfactory results only if the barrages are continuous. Oblique or enfilade fire should be used. By day we use permanent aerial observation; by night we fire on the road or crossing to be made impassable with salvos or volleys at irregular intervals, at the rate of 50 rounds per hour for the 75; 38 rounds per hour for the heavy artillery. If the road is taken in enfilade, cover a certain width each time. Certain gas shells give incontestable results on sheltered regions, such as ravines and woods.

FIRE WITH GAS SHELLS.

Gas shells give good results in case they are used under the conditions which are requisite for their employment. These conditions are the following:

(*a*) *Atmospheric conditions.*—The wind carries the cloud and increases the rapidity with which it is diffused. Either intense dry cold or humidity make the cloud less effective. If the wind is higher than 3 meters per second, if it is freezing weather, if it is foggy or raining, gas shells should not be fired. (By fog, a thick, heavy fog is meant; and by rain, a heavy fall and not a sprinkle.) *Atmospheric conditions dominate* the whole question whether gas shells shall be used.

(*b*) *Duration and density of fire.*—It is necessary to devote sufficient density of fire to the target and to continue the action during a long enough time (several hours), sometimes at a slow rate of fire and sometimes more rapid.

A strong initial density increases the chances of results on the personnel surprised. It is therefore well to fire for adjustment with shells of the same weight and to open with gas shells for effect in order to achieve the benefits of surprise.

Prolonged bombardment with gas shells fatigues the personnel of the enemy batteries by forcing them to wear masks while

serving their pieces. The annoyance of doing this induces the men to take off the mask after a certain time; a sudden recurrence to dense fire during the course of the firing may then produce serious results. The necessity of having prolonged and intense action, together with that of having precise fire, make it advisable to put certain batteries in charge of delivering the fire with gas shells on the designated targets. Batteries are chosen which can fire on the targets obliquely or in enfilade.

Above all, avoid firing a little here and a little there, for with such fire one is certain to get no results.

(*c*) *Radius of action.*—The following results refer to favorable atmospheric conditions.

The 75 mm., radius of action 10 meters in all directions; the effectiveness of the cloud does not last long, and disappears when the cloud has moved 50 meters.

The steel 120 mm. and semisteel 155 mm., radius of action 10 meters; the effectiveness disappears when the cloud has moved 100 meters.

The 58 mm., radius of action 15 meters; the effectiveness disappears when the cloud has moved 150 meters.

The clouds hold together better and penetrate shelters better in proportion to their size; hence the special advantage in using the 58 mm. when targets are within its range.

The above data show that gas shells should fall very close to the target and to the windward of it.

It is not advantageous to fire more rapidly than six rounds per piece per minute; too frequent explosions help scatter the clouds. Open ground and wooded bottoms increase the duration of the effectiveness of the gas.

(*d*) *Precautions.*—If the wind carries toward the enemy gas shells can be used 150 to 200 meters in front of our infantry with no danger; it is merely necessary to avoid an abnormal round falling in our lines.

If the wind is toward our lines masks must be put on up to 400 or 500 meters from the points of impact, to be sure of not being discommoded.

If the infantry is to attack, and if the wind carries toward the enemy, there is nothing to fear from a fire directed on the first enemy lines if the attacking infantry has 200 or 300 meters to cross after the fire ceases.

The moppers-up should not immediately descend into the enemy shelters, but should first clean them out with explosive and incendiary grenades, which will facilitate ventilation.

PART THREE.

THE ARTILLERY DURING THE EXECUTION OF THE ATTACK.

The artillery protects the infantry from the fire of the enemy artillery—

First. By counter-battery fire.—Counter-battery fire continues during the attack itself and while the infantry is getting installed in the limited objectives. It is supplemented by fire directed on command posts and observation stations.

Second. By accompanying fire.—Direct support or accompanying fire is the artillery fire moving immediately in advance of the wave of assault in order to keep the defenders underground until the moment when the attackers reach their lines. This mission generally falls to the duty of the 75's.

A priori, the speed of advance of the fire is determined by the commander (it is generallly 50 meters per minute over easily traveled ground, and 25 meters over difficult ground). The assaulting wave follows just behind the last shell bursts, about 50 meters from the nearest. The infantry must follow the shells and march under the fire of its artillery. This imposes on the latter the obligation of precise fire.

The density of the fire is about one round per minute per 15 meters front, which is sufficient to have the successive advances of the fire clearly marked on the ground and easily recognized by the infantry. When the infantry reaches the limit of its objective the accompanying batteries make a barrage before its front.

By general covering fire.—This fire is directed on—

The trenches not yet attacked in the phase of the combat considered.

The enemy works on the flank of the attack.

The probable zones where the enemy will assemble.

The communication trenches and paths in the zone of attack by which the enemy counter attacks may approach (increased density of fire being directed on the nuclei of communications).

Finally, on the lines of communication in the zone of action of the divisional artillery.

For this covering fire the division has at its disposal the batteries of 75's not used for direct support, the heavy howitzers assigned to the division, and the guns which the army corps may put at its disposal.

NOTE.—The mission of direct support and of covering the attack terminates only when the infantry has finished its advance, firmly installed itself on the conquered ground, and reestablished its normal liaisons with the rear. The generals commanding the Army corps and infantry divisions then coordinate the barrages of the various artillery battalions or commands so that there are no gaps in the barrage and no waste of fire by superimposition or dispersion. With all possible expedition they draw up a plan of counter preparation.

By box barrages.—The ground to be conquered is surrounded during the whole progress of the attack by a barrage, which, so far as possible, is made by large-caliber pieces. This barrage conceals the attacked zone from view from the rest of the field of battle and makes it inaccessible for reenforcements and counter attacks.

This fire is generally directed on the communication trenches of the unit attacked, with increased density at the points of intersection of trenches.

When an attack is simultaneous with attacks on the adjoining sectors the box barrage becomes merely a frontal barrage laid down beyond the region attacked.

By fire on command posts and observation stations.—These fires are combined with the fire for neutralization of the enemy batteries.

By fire on lines of communication.—By this must be understood fire on the distant lines of communication and on the communication trenches which lead right up to the units attacked.

By fire against counter attacks.—Counter attacks may start either from the front (in which case the batteries delivering accompanying fire are sufficient to ward it off) or from a flank (when an attacking unit is checked by some obstacle and leaves the flanks of an adjoining unit uncovered). In this case it is necessary to have available batteries with observation stations

at their disposal, by which they can follow the progress of the attack and intervene on their own initiative. This latter condition can not often be obtained. It then becomes necessary to connect these batteries with a wireless station, so that their fire can be launched by direct request of the aviator without intervention of the higher command, which would involve loss of time.

By movements of batteries.—Movements of batteries are necessary for the laying down of barrages in front of the new front, for the execution of the new plan of counter preparation, and the development of the new plan of action for the continuation of the offensive.

Movements of batteries should be reduced to the minimum, for a battery moved in the course of combat does very little work, and even runs the risk of being destroyed before firing a shot.

Nevertheless, movements for the following purposes must be contemplated: To sustain the morale of the infantry, to lessen the ranges (whence the necessity on the offensive of pushing the artillery as far forward as possible), to facilitate liaisons.

These movements should be facilitated by very thorough reconnaissance of the routes to follow, preparation of means of crossing the friendly and enemy positions, the detail of sufficient personnel for preparing the routes, selection of positions beforehand, and even their construction, and the permanent installation of pieces (all camouflaged), if the new positions are to be behind the original front of the attack.

NOTE.—During the attack, *all oblique fire* on the ground over which the infantry is actually advancing is prohibited.

By fire against attempted enemy counter offensives.—Our artillery should immediately answer every preparation for an attack on our positions by the counter preparation, for which plans must be made immediately after the last attack, and by barrage fire in case the enemy attack should debouch in spite of the counter preparation.

See discussion of special defensive fire below.

PART FOUR.

SPECIAL DEFENSIVE FIRE.

The object of these fires is to stop the enemy before they penetrate our lines. The Artillery therefore works:

A. During the course of the enemy preparation, by *counter-preparation fire* on the enemy massed in his works.

B. At the moment of the attack itself, *by barrage fire.*

(A) OFFENSIVE COUNTER PREPARATION.

The German attack is generally preceded by bombardment on an extended front, at some point of which, after a certain time, the fire increases in intensity until it becomes preparation fire proper. Attention must therefore be devoted to discerning the variation of activity of the enemy artillery. Only permanent observation stations of wide outlook are capable of this, by virtue of their ability to make comparison in time and space. The determination of the probable point of attack is therefore a duty of the headquarters observation stations, or, even better, of the airplanes, whose view is less obstructed by the smoke and dust of the bombardment.

Use should also be made of the information obtained from prisoners, deserters, listening posts, etc.

Reports by defenders who see only a very limited part of the field of battle are only of secondary value.

The counter preparation is ordered by corps or division commanders, as the case may be. It is effective only when *perfectly prepared.*

The corps headquarters therefore draw up a plan of offensive counter preparation providing for all details of these actions, distinguishing between the case of a general attack and that of partial attacks on any given part of the front.

The counter preparation comprises:

(*a*) *For the field artillery.*—Violent fire for effect for a limited time (about five minutes) against the enemy first-line works

(trenches, supports, communication trenches). The staff determines how often and for what length of time this fire is repeated. Whenever possible, the battery commanders should use fire by piece or alternate platoons to provide for cooling and examination of the pieces.

(*b*) *High-angle-fire artillery.*—Continuous demolition fire on the same works, especially on shelters, command posts, and junctions of communication trenches, and also on first-line trenches where the form of the ground is such that the field artillery might not be sufficiently effective.

(*c*) *For the long-range artillery.*—Counter battery and interdiction fire on approaches in the rear (communication trenches, tracks, roads, etc.).

It will be seen that the general mechanism of the counter preparation is similar to that of the preparation.

(B) BARRAGE.

The object of the barrage is—

First. To block the enemy attack at the very moment it deploys.

Second. To prevent the arrival of reinforcements and reserves sent to strengthen it.

The barrage is executed by the field artillery and by the high-angle-fire heavy artillery, supplemented by the action of the heavy long-range batteries on the rear of the enemy position. Everything should be organized so that in case of need the barrage can automatically succeed the counter-preparation fire.

FIELD ARTILLERY BARRAGE.

(*a*) *Front.*—A distinct sector is assigned to each battery. If there are enough batteries available the fire of several batteries may be superimposed on the same sector, but such duplication is used only to reinforce a barrage which is already sufficient and to replace it if it should become insufficient. There should be, wherever possible, such an organization that for each infantry unit there is a corresponding artillery unit charged with the barrage fire for the sector concerned (for example, a battalion of artillery for each infantry battalion).

(*b*) *Targets.*—The barrage should form a continuous curtain, as close to our lines as is consistent with the safety of our infantry, from 100 to 200 meters in front of our trenches,

depending on the range from which the artillery fires (2,000 or 4,000 meters). Barrages made by enfilade fire from whatever range can be laid down within 60 meters of our lines. As soon as the effective barrage has been established the range is progressively increased until the barrage is on the enemy front-line trenches, from which the successive assault waves are particularly vulnerable at the moment when they are massing or are leaving the jumping-off trenches. The effect of the barrage is further supplemented by searching fire in depth, directed against the trenches and lines of communication where the successive enemy elements may be passing or resting.

If the enemy should have penetrated our lines all or part of the barrage should be brought back at the request of the infantry to bear on the captured portions of our lines.

(*c*) *Density of fire.*—At the opening of fire the rapidity of fire should be as great as possible. The delivery of fire is afterwards modified to suit the circumstances and the requests of the infantry in the first-line trenches, with whom the battalion or battery commander should put himself in intimate relations. As a rule, there should be a rapid rate of fire at first, followed by a slower rate obtained by firing by piece or section while the others are cooling, being examined, or cleaned.

Calculations should be based on a density of 1 round per minute on each 10 meters of front. Assuming that each gun fires 5 rounds per minute, it is necessary to assign at least one battery for each 200 meters of front. (As a rule, fire should not exceed 100 rounds per hour.)

(*d*) *Opening of barrage fire.*—Barrage fire is opened at request of the infantry (by telephone, visual signals, etc.), or when battery commanders receive indications from observation stations (signal by Ruggieri lights, release of small balloons, display of streamers from a balloon basket), or when the situation seems to them to demand this kind of fire (in case, for example, a burst of infantry fire is heard at night, or a gas attack is noted in the daytime, etc.).

Barrage fire is stopped when the infantry asks for its cessation. When all direct and lateral communications are cut, it may be stopped on the responsibility of the artillery commander of the sector when he judges that the enemy attack has been broken up.

Barrage from heavy howitzers is delivered automatically on the first line only. In other cases it is ordered specially by the

commander of the artillery of the sector, either on his own initiative or on request of the infantry. It is always stopped at the order of the infantry commander.

Barrage from the 75-mm. trench mortar is opened under the same conditions as that of the field artillery. Other trench mortars execute the barrage under the orders of the colonel commanding the infantry of the sector, or automatically when battery commanders perceive indications of a hostile attack. It is stopped at the order of the colonel commanding the infantry.

Heavy artillery batteries other than howitzers deliver barrage at the order of the general commanding the artillery of the army corps.

(*e*) *Preparation for the barrage.*—The barrage depends on a prearranged scheme called the *barrage plan*, which includes all the details necessary for its execution. This plan includes the following:

1. Targets.
2. Rate and method of fire.
3. Provisions for night barrages.
4. Observation stations and liaisons to be established.
5. The orders for each battery.
6. The artillery support to be requested from neighboring sectors.

CONTINGENT FIRE.

(*A*) *Harassing fire.*—Harassing fire is for the purpose of embarrassing the movements of enemy troops and supplies. The corps commander each day issues orders for the harassing fire to be executed the following day. It is principally directed on routes and trails traveled by reliefs and supplies, on railways (narrow or standard gauge) used for transportation of the various supplies; on cantonments and bivouacs; on halting places used in the distribution of supplies; and on working parties.

Harassing fire is executed *by surprise*, and therefore by small or medium caliber rapid-fire pieces, generally 75's and 105's. The fire should never be continued longer than the time presumed necessary for the endangered personnel to find shelter. On cantonments, bivouacs, working parties, trails, and railways one or two volleys will generally be sufficient, the fire being repeated at different hours of the day or night. On a halting point for vehicles (ammunition columns, traveling kitchens, etc.) two or more volleys may be fired, depending on the number of

vehicles using the point and on the freedom of movement which the ground affords them. The same principle applies to fire on railway stations.

NOTE.—When information as to the enemy's movements is sufficiently exact, this fire is carried out by several pieces, and the tables of concentration are used.

(*B*) *Fire in reprisal.*—Fire in reprisal is intended to keep up the morale of our infantry by demonstrating that the artillery is looking out for it, and to convince the enemy of our willingness to return his fire with interest. It is directed on trenches and cantonments, following the enemy's bombardment of our trenches or cantonments.

A plan of fire for reprisal decides in each instance when it should be opened.

(*1*) *On trenches* rapid fire is used, firing a greater number of projectiles than is used by the enemy (if possible, 2 rounds for 1). The fire is directed on the second lines and shelters where the personnel is almost exclusively to be found. The pieces used are 75-mm. guns, firing instantaneous fuses, 58-mm. trench mortars, and, exceptionally, howitzers firing delayed-action fuses. It is delivered at the request of the infantry or on the initiative of battery commanders.

(2) *On cantonments*, several volleys are fired by the field artillery or, if the range is too long, by the heavy artillery, using shrapnel or incendiary shells.

CONCENTRATIONS OF FIRE.

Concentrations of fire give material and moral advantages due to—

(*a*) The effect produced on the personnel by the variety of lines of fire and of the projectiles used.

(*b*) The possibility of attacking an obstacle from various directions.

(*c*) The increased rapidity of fire due to the simultaneous use of a great number of pieces.

(*d*) The scattered location of the pieces, which makes the batteries less vulnerable.

(*e*) The utilization of enfilade fire.

(*f*) The decreased importance of an error in the firing data which affects only part of the pieces in action.

For these reasons concentrations of fire are employed in demolition fire against the enemy works, in counter-battery fire,

in offensive counter preparation, against cantonments, bivouacs, and railway stations, and on important points of passage.

Concentration of fire is ordered by generals commanding divisions, corps, or armies, who, for certain purposes and in order to avoid delays, may delegate their authority to their respective artillery commanders. In order to make immediate concentration of fire possible, a preliminary study is made, the results of which are embodied in "tables of concentrations."

All artillery staffs (Army, corps, division) must have in their possession a document of this kind, which shows for each square on the battle map the batteries which can fire on any given target. Thus they can see instantly the number and caliber of the units which can fire on any given target. An extract from this table is sent to each commander of a battery, battalion, or higher artillery unit interested. The necessary rangings are made.

When the commander sees fit, concentration of fire is accompanied by a show of infantry activity. This is almost always necessary when the first enemy line is to be fired on, the purpose being to induce the enemy to man the first line.

The infantry are always warned when concentration of fire is planned, in order that they may take the necessary measures of security.

PART FIVE.

PREPARATION OF THE WORK OF THE ARTILLERY. PLANS OF ACTION.

THE OFFENSIVE.

FIRST RÔLE OF THE ARTILLERY.

The rôle of the artillery on the offensive is to facilitate the capture of the objectives of an infantry attack, to help the infantry to hold the ground it has won, and to aid it in exploiting the success.

During the preparation of the attack it must (*a*) destroy the enemy artillery before the attack, neutralize it at the moment of the attack; (*b*) destroy the defensive works of the enemy; auxiliary defenses, flanking works, shelters, communication trenches, observation stations, and maintain the demolitions already made; (*c*) prevent the enemy from recovering, and for this purpose direct fire on the rear to block reliefs and the arrival of reenforcements, food, materials, and munitions.

During the attack it must give the infantry constant support. It must therefore effect new preparation on targets which are holding up the infantry advance, either firing from the original positions or sending some batteries forward.

Each piece is assigned a particular rôle, suitable to its type and caliber:

The trench artillery.—Demolition at short ranges.

The field artillery.—Demolition of weak fieldworks, protection of the infantry, barrages, counter-attack batteries, counter batteries, and interdiction fire.

The heavy howitzers.—Destruction of enemy fieldworks, contingent barrages.

The heavy guns.—Counter-battery and demolition fire beyond the limits of action of the field artillery or the heavy howitzers.

The essential factors in offensive preparation are *surprise and action in depth.*

To obtain *surprise*, the length of preparation for the attack is made as short as possible, and an effort is made not to disclose to the enemy the moment of launching the attack by changing the rate of fire.

The purpose of *action in depth* is to effect simultaneous preparation by the artillery on the greatest possible number of successive enemy works. Only when this is done is there hope of an important if not decisive success by preventing the enemy from reestablishing his defenses in time to serve him.

The succession of the offensive actions of the infantry and artillery must be executed in an orderly manner, but as rapidly as possible in order to make it impossible for the enemy to recover himself. The artillery's work of destruction should therefore simultaneously attempt to achieve:

Power, which makes the attack easy.

Depth, by which it becomes possible to give wide scope to each offensive action.

Continuity, which is the means of securing rapidity in the succession of these same offensive actions, thanks to an advance of the artillery parallel to that of the infantry.

Before the battle, and covering each phase of it, there is prepared a *plan of action of the artillery*, which comprises the following heads:

1. *Organization of the command.*

2. *Designation of the targets.*

3. *Allotment of artillery to the attacking units.*—It must never be forgotten, in preparing this feature of the plan of action, that exaggeration in the density of the artillery always reacts by reducing the width of the front on which it is possible to attack with the means available at a given time, and that an increase of artillery gives an increase of fire only when it is possible at the same time to solve the difficulties (in supply, observation, etc.) which result from the increase.

4. *Formation of unattached artillery into organized units.*—Such unattached artillery will rarely exist before the general attack in order not to restrict the front of attack. It comprises fractions of artillery taken from units which, for the moment, are to act on the defensive and do not need their full regulation strength. These fractions are chosen among the most mobile batteries, since their rôle is to act as immediate reenforcements to certain artilleries or in the rapid exploitation of the full possibilities of a successful attack.

5. *Position.*—We should push part of the artillery as far forward as possible, in order to get the advantage of the full range of the pieces. On the one hand, the batteries must not be crowded in too restricted a space, and provision must be made for favorable conditions for fire on the first enemy position; these considerations lead to disposing the artillery in echelon in depth according to its missions and the characteristics of the pieces and of the terrain.

6. *Grouping into commands*, which generally comprise different calibers, in order that the command can execute all the missions in the zone of action assigned to it.

7. *Zones of action.*—Normal and contingent.

8. *Liaisons.*—Telephones, visual signals, liaison officers.

9. *Observation.*—Aerial and terrestrial; *intelligence (wide-view) observation stations*, positions chosen by the corps; *ranging and fire (close-view) observation stations*, positions chosen by the artillery battalions and batteries. Map and table of the observation stations.

NOTE.—During the combat the liaison and observation detachment and the infantry must cooperate in choosing positions for observation stations, in order to assure the continuity of the operations. We must always be able to act, and to this end a first observation station must be chosen by means of which the mission can be executed; if necessary, it can be moved after a later and fuller reconnaissance.

10. *Work of installation of artillery of all calibers.*—Minute reconnaissances of battery positions, installation of telephone lines, rapid construction of *thoroughly camouflaged emplacements with wide fields of fire.*

11. *Movements of the artillery.*—The advance of the artillery should be by echelons, and almost continuous. Plan of movements must be constantly corrected during the whole course of the battle, and must fix for each battalion of field or heavy artillery the position which it shall occupy before, during, or after the contemplated attack, and the probable moment when these positions should be occupied.

12. *Ammunition supply.*—We make estimates providing for the daily supply to the batteries of a "day of fire." The tonnage is considerable (1,200 tons for an army corps of two divisions). Location and preparation of the ammunition depots, delivery depots, and intermediary depots. Construction of the lines of communication (narrow paths).

EXPLOITATION OF THE SUCCESS.

The objective given an attack constitutes *a minimum line, the attainment of which must be made certain, but beyond which the attack may and should advance.*

The attack will stop at the objective line long enough to allow renewal of contact with the enemy, the realignment of the units, the reorganization of the liaisons, and the arrival of fresh troops, and will then resume its advance.

Exploitation of the success must be considered in the two phases which characterize the offensive battle; on the one hand, in the successive actions having for their object decisively breaking the enemy's front, where it is what may be called *tactical exploitation;* and, on the other hand, in the period which follows the rupture, when it becomes *strategic exploitation* or *pursuit.*

I. Tactical exploitation.

Tactical exploitation takes place immediately after the attack, and takes advantage of the disorder caused among the enemy. It follows a *plan for exploitation* which has been prepared before the attack.

The principal points treated in this plan are: The zones and distribution of the exploiting troops, the engagement, the artillery support.

First. Zone of exploitation; distribution of the troops charged with it.—The division commanders devote to exploitation all troops not employed in capturing the enemy position. The corps commanders will place at the disposal of the division commanders of the first line, having a favorable zone for exploitation, all or part of the infantry divisions of the second line. One or more exploiting detachments are organized, comprising troops of all arms (the artillery should, as far as possible, comprise batteries which have not been engaged in the preparation of the attack).

The commanders of the exploitation units (divisions, brigades), precede their troops and accompany the division and brigade commanders of the first line (this is obligatory). They are accompanied by their cavalry and artillery reconnaissance parties.

Second. Engagement.—The exploitation troops have for their objective the last enemy batteries and important points of the

terrain in a radius suitable to their effective force and to the condition of the enemy. Their action is prolonged by new elements pushed farther on, and by the major units charged with the pursuit.

Third. Support of the exploitation troops by the artillery.—At the moment when the exploitation troops are about to engage, the artillery barrage is carried forward over a series of successive positions and the advance of the infantry behind the artillery fire is carried out under the same conditions as in the beginning of the attack. Moreover, the artillery must protect the advance of the infantry by neutralizing or destroying the often distant hostile artillery. It therefore becomes necessary to provide for and to organize a rapid change in position of a portion of the artillery comprising mobile guns of great range, field guns, and howitzers. These pieces are grouped in commands formed of:

First.—Batteries installed very near the departure trenches and not disclosed before the attack.

Second.—Available batteries of very mobile matériel which have not taken part in the first part of the attack, or the batteries which have been posted farthest back, and which are therefore the first to be left out of range.

The artillery will change position by echelons, making a considerable advance each time they move, in order that the same battery may not change position too often (two or three echelons of artillery about 2 kilometers apart require advances of 4 to 6 kilometers each time).

II. Strategic exploitation.

Strategic exploitation is under the jurisdiction of the army and of the group of armies.

The pursuit troops (of divisions in line and supported on the flanks) are powerfully assisted by the aviation service, which keeps them informed, and which also uses bombs and machine guns against columns, batteries, trains, railway stations, etc.

The pursuit begins as soon as the cavalry divisions have passed the infantry. This cavalry is given distant objectives, principally junctions of important lines of communication and depots which they are to destroy.

As soon as the cavalry has taken the advance, the infantry divisions are formed in route column, their duty being to advance quickly and follow the cavalry as close as possible. In

order to secure liaison between the pursuing divisions, the corps establishes behind each one a liaison line.

The artillery is distributed among the divisions. We push the reconnaissance personnel with the telephone and wireless wagons as far to the front as possible, but we keep the artillery back sufficiently in rear of the heads of the columns. We form a series of mixed artillery groups, leading off with the long-range artillery and some field batteries; farther back we place field and howitzer batteries. In the rear divisions we place the artillery at the head of the column.

Getting in contact.—In combat, of whatever form, we always act on the following principles:

First. *In all defensive situations* we hold the front with a minimum of rifles and machine guns on the first line and keep as many men as possible in reserve.

Second. *On the offensive* we never risk infantry against organized positions without first causing the attack to be preceded by an intense artillery preparation. We economize the infantry and absolutely forbid all dense formations.

Third. In all situations we insure close liaison between the infantry and the artillery, even if it results in slackening the action.

PLAN OF ACTION OF THE ARTILLERY.

The rôle assigned the artillery is defined in—

The general plan of action, made by the general commanding the Army.

The plans of engagement and plans of action of the artillery, made by the corps and divisions.

The plan of action of the corps artillery comprises—

The plans of action of the divisional artillery, and

The plan of action of the corps artillery.

A detailed study of the ground is made (study of the battle map, examination of photographs, appraisal of the importance of targets, facilities of the artillery for occupying and advancing over the ground, existing or possible observation stations, trails, roads, railways). *An estimate of the necessary ammunition* for the accomplishment of the missions given to the artillery is also drawn up.

This plan of action is covered by all the documents by means of which it is possible to give execution orders relating to the different phases of an offensive operation. It comprises the following heads:

(*a*) *Composition of the artillery.*—Enumeration of the artillery units.

(*b*) *Assignment of missions.*—Table showing, for each target, the batteries used and the ammunition to be provided.

(*c*) *Organization of the command.*—Table which gives the location of the command posts, as well as the telephone and wireless connections of the different authorities.

(*d*) *Table of the daily use of the artillery.*—Showing for each artillery unit, at each instant of the preparation of the attack, its targets or missions, the corresponding consumption of ammunition (sometimes the rate of fire), when advisable, the infantry units in support of which the batteries act, and hence the liaisons to establish. This table makes it possible for us to follow the execution of the fire and, in case a battery should be put out of action, to pick out quickly the unfulfilled mission which must be entrusted to another unit.

(*e*) *Organization of counter-battery work.*—Table of demolition or neutralization fire, showing the order of urgency of the destruction of batteries.

(*f*) *Movements of artillery.*—Table showing the units moved and their new positions, the modifications this causes in the organization of the command, and the probable routes of the units.

(*g*) *Tables of concentrations of fire.*

(*h*) *Plan of observation and of liaisons,* comprising—

The location of the observation stations and their zones of observation.

The points of balloon ascensions.

The airplanes at the disposal of the artillery and the location of the wireless aerials.

The wireless call signals and wave lengths.

The telephone connections.

The location of the visual signal stations and the units they serve.

Sometimes the wireless telegraph ground stations and the liaisons which they provide.

The measures taken for the organization of the new observation stations and the liaisons to be effected to connect them with the original system.

(*i*) *Plan of the supply of artillery and infantry ammunition,* showing—

The allotments of the batteries.

The location of the different depots, and their allotments.

The means of transportation and the routes.

An *appendix* shows the plan for supplying the advanced lines when they have reached their objectives, and includes—

The location of the new depots and their allotment.

The preparation of the lines of communication.

The modifications in the assignment of the personnel detailed to handle supplies.

EMPLOYMENT OF THE AVIATION SERVICE DURING THE DIFFERENT PHASES OF BATTLE.

Aviation interests us here only from the artillery point of view.

During the preparation.—Reconnaissances; vertical and oblique photography; adjustment of fire; observation of demolitions, which allows the artillery to take the results of the day's work into account when planning the program for the next day.

During the attack.—(*a*) Observation of neutralization and destruction fire against the enemy artillery.

(*b*) Observation of the artillery fire for direct support and the covering of the attacks, and maintenance of the liaison between the infantry and the artillery.

(*c*) Rapid transmission of the orders of the corps commander, by dropping weighted messages at the divisional, brigade, and regimental command posts.

(*d*) Keeping the commander informed of the positions reached by the troops, the obstacles encountered by their advance, and the counter efforts of the enemy.

THE DEFENSIVE.

The complex missions which are incumbent on the artillery the necessity under which it labors of acting quickly, in mass and with precision, oblige the command to make minute preparations for its use. Every Army, corps, and divisional staff therefore makes under the direction of the commander.

Plan of employment of the artillery, covering all contingencies and comprising the following heads:

1. Organization of the command.
2. Distribution of missions among the units.
3. Rôle of the heavy artillery, and organization of the counter batteries.
4. Offensive counter preparation.

5. Plan of barrages.

6. Fire for reprisal.

7. Table of concentrations of fire.

8. Plan of observation and of liaisons, with maps of the observation stations and their normal and contingent distribution among the artillery units; panoramas from the balloon; material organization of the observation stations; distribution of the observation personnel and the orders of the observers; maps of the liaisons of all kinds between the observation stations, the balloons, the wireless telegraph aerials, the command posts, and the artillery battalions.

Plan for the contingent reenforcement of the sector by batteries of all calibers brought from outside the sector. This plan contemplates the case of an important attack by the enemy. It comprises—

1. A list of the artillery units expected to be available for reenforcements (this list is furnished by the Army).

2. The organization of the command.

3. The distribution of missions and positions.

4. The organization of the command posts, visual signal stations, and liaisons.

Note.—The emplacements of the batteries, the command posts, the observation stations, and the telephone communications for which this document provides are prepared in advance, as well as all the documents of firing data (lists of coordinates, plotting boards and firing-data books).

The above is an enumeration of the principles by which the employment of the artillery is at present regulated. The one thing which must never be forgotten is that this arm is valuable only for those who know how to use it.

It therefore requires hard-working, educated officers, full of the love of their profession, and, above all, conscientious.

The idea of perfecting their professional knowledge, of achieving perfect execution of all the missions which may be entrusted to them, whether great or small, must always be present to the mind of every officer.

In this way alone will the officer be on good terms with his conscience and useful to his country.

APPENDIX I.

SAFETY ZONE TABLES.

75-MM. GUN.

Zone to be maintained between the center of burst and the first elements of infantry in accompanying fire during an attack.

The depth of this zone is one-half the zone of dispersion (range and fuse-setting), to which is added, when shells are used, the distance to which dangerous fragments are projected by the base sheaf (about 50 meters).

(*A*) *Open ground.*

1.—HORIZONTAL GROUND.

Ranges.	Safety zone (in meters).			
	Shell.		Shrapnel.	
	Percussion.	Time fuse.	Percussion.	Time fuse.
2,000	138	292	41	93
2,500	153	300	50	98
3,000	165	307	60	95
3,500	178	308	68	101
4,000	192	324	75	109
4,500	208	338	81	118

2.—5 PER CENT GLACIS (ASCENDING TOWARD ENEMY).

2,000	101	208	36	54
2,500	118	231	42	61
3,000	133	248	43	70
3,500	150	264	50	79
4,000	165	283	66	88
4,500	183	304	72	100

3.—5 PER CENT COUNTERSLOPE (DESCENDING TOWARD ENEMY).

2,000	406	(1)	325	(1)
2,500	257	515	184	(1)
3,000	235	434	153	281
3,500	225	384	142	272
4,000	234	387	140	244
4,500	244	387	144	236

[1] Impractical.

For glacis, the grade of which is more than 5 per cent, the above figures may be slightly decreased. For counterslopes, the grade of which is more than 5 per cent, the ground is in a "dead angle" up to about 3,000 meters; beyond 3,000 meters the safety zones are very wide.

The 75 mm. is not suitable for accompanying fire directed on counterslopes.

(*B*) *Uniformly wooded ground.*

To avoid premature bursts in the trees, the safety zone must be made wider in percussion fire; this is not necessary in time-fuse fire, as the mean points of burst are above trees of average height.

The following table gives the additional widths required for trees 10 meters high:

Ranges.	Additional meters.		
	Horizontal ground.	5 per cent glacis.	5 per cent counterslope.
2,000	140	80	[1]
2,500	100	70	200
3,000	70	60	120
3,500	55	50	75
4,000	45	40	60
4,500	35	30	45

[1] Impractical.

Safety zones to be maintained between the center of burst of 75-mm. fire and our first-line positions.

(Tables applicable to shell fire.)

(*A*) *Open ground.*

Ranges.	Safety zone (in meters).		
	Horizontal ground.	5 per cent glacis.	5 per cent counter-slope.
2,000	88	51	366
2,500	103	68	207
3,000	115	83	185
3,500	128	100	175
4,000	142	115	184
4,500	158	133	194

(*B*) *Uniformly wooded ground.*

Ranges.	Increase in elevation for the height of trees.		
	Trees 5 meters high.	Trees 10 meters high.	Trees 15 meters high.
2,000	130	200	280
2,500	110	160	220
3,000	90	130	170
3,500	80	110	140
4,000	80	100	130
4,500	70	90	110

APPENDIX II.

OTHER TABLES.

TABLE I.—*Estimated expenditure of ammunition for the destruction of auxiliary defenses.*

Range.	Calibers.	Ground conditions at target.	Ammunition.		Estimated requirement for a wire entanglement 30 meters deep.
			Projectile.	Fuses.	
Less than 1,000 meters.[1]	58 No. 2 or Van Deuren (V. D.).	Any kind of ground and of slope.	Bombs.....	Instantaneous on percussion.	200[2] bombs small[3] model; or 120[2] bombs large[4] model.
From 2,500 to 4,000 meters.	75.....	Glacis or very slight counterslope; hard ground or muddy clay.	Shell.....	Supersensitive instantaneous nondelay.	600 shells at 2,500 meters;[5] 700 shells at 3,000 meters;[5] 800 shells[6] at 4,000 meters.[5]
From 5,000 to 7,000 meters.	75.....	Glacis or horizontal; dry ground.	.....do.....	Supersensitive	1,000 shells at 5,000 meters;[5] 1,200 shells at 7,000 meters.[5]
From 2,000 to 4,000 meters.	155 howitzer.....	Steep counterslope....	Shell or D shell.	.....do.....	150 A and 300 D, at 2,000 meters;[6] 200 A and 300 D, at 3,000 meters;[6] 240 A and 360 D, at 4,000 meters.[6]
From 5,000 to 7,000 meters.	155 gun or 155 Schneider howitzer.	Counterslope.....	.....do.....	.....do.....	250 A and 350 D, at 5,000 meters;[6] 300 A and 400 D, at 6,000 meters;[6] 350 A and 400 D, at 7,000 meters.[6]

[1] The V. D., as well as the 58 No. 2, firing the large model bomb, carry only up to 600 meters.
[2] To open a breach 40 meters wide.
[3] Bombs weighing 16, 18, or 19.5 kilograms.
[4] Bombs weighing 35 or 40 kilograms.
[5] To open a 25-meter breach. If the wire entanglement is more than 30 meters deep, use 400 additional rounds for every 30 linear meters increase in depth. If the ground is countersloping, multiply these figures by the coefficient *a* of the table of probable errors in range.
[6] To open a 25-meter breach.
NOTE.—If the entanglement is made of *chevaux de frise*, always use the retarded-action fuse.

TABLE II.—*Estimated expenditure of ammunition for the destruction of shelters.*

EMBRASURE FIRE.

Ranges.	Protection of the shelter.	Calibers.	Ammunition.		Estimated requirement.
			Projectiles.	Fuses.	
					Rounds.
Less than 3,000 meters.	Any kind..	75.....	Explosive...	Instantaneous or supersensitive.	100

CRUSHING FIRE.

Less than 1,000 meters.[1]	Medium.[2]	58 No. 2 or V. D.	Small model bomb.[4]		100
			Large model bomb.[5]	Delayed action.	80
	Strong[3]...	240 trench mortar or 300 trench mortar.	Bomb.....	.....	80
From 2,000 to 4,000 meters.	Medium...	155 howitzer.	Steel or semisteel shell.	Delayed action.	80
	Strong....	220 or 270..			
More than 4,000 meters	Medium ..	155 gun...	.....do.....	.....do....	150

[1] The V. D., as well as the 58 No. 2, firing the large model bomb, carry only up to 600 meters.
[2] Roof formed of alternate layers of logs and earth.
[3] Roof of concrete or of rails and concrete.
[4] Bombs weighing 16, 18 or 19.5 kilograms.
[5] Bombs weighing 35 or 40 kilograms.

TABLE III.—*Estimated expenditure of ammunition for the destruction of trenches.*

Ranges.	Calibers.	Ammunition.		Estimated requirement.
		Projectiles.	Fuses.	
Less than 1,000 meters.[1]	V. D., or 58 No. 2, or 220 trench mortar.[2]	Arrow, bomb, bomb.	Delayed action.[3]	80 to 100 rounds per important point.[4]
From 3,000 to 7,000 meters.[5]	75.....	Shell.....	...do.....	10 rounds per linear meter.
Do.....	.....	Elongated shell.	...do.....	80 to 100 rounds per important point, viz: 3 or 4 rounds per linear meter (frontal fire); 1.5 rounds per linear meter (enfilading fire).
		Semisteel shell.	...do.....	Increase these figures ¼ for fire of semisteel shells.
From 2,000 to 5,000 meters.	220[6].....	Elongated shell.	...do.....	70 rounds per important point.
		Semisteel shell.	...do.....	100 rounds for the semisteel shell.
From 5,000 to 7,000 meters.	155 gun or 155 Schneider howitzer.[7]	Elongated shell.	...do.....	5 or 6 rounds per linear meter, according to the range (frontal fire).

[1] The V. D., as well as the 58 No. 2, firing the large model bomb, carry only up to 600 meters.

[2] To reinforce the action of the 58 on the important points.

[3] Always mix with the delayed-action fuses about ¼ of nondelayed action, fired toward the end of the demolition, in order to diminish the number of fougasses.

[4] A trench or communicating trench taken in enfilade will be completely knocked to pieces for a length of 100 meters with 300 small bombs (58 or Van Deuren) or 150 large bombs.

[5] Fire as far as possible exactly in enfilade.

[6] To reinforce the action of the 155 howitzer on the important points.

[7] *Safety zone.*—Give the infantry a prohibited zone of 200 meters during fire with the 155 howitzer. The troops must also be made to take shelter from the fragments, which may be projected several hundred meters to the rear.

TABLE IV.—*Estimated expenditure of ammunition for the destruction of the parts of a fort.*

Targets.	Calibers.	Good ranges in kilometers.	Ammunition.		Estimated requirement.
			Shells.	Fuses.	
Rampart shelters.	293 howitzer.	8	Semiarmor piercing.	Long delayed action base fuse.	100 rounds for targets at ranges of less than 9 kilometers. 150 rounds for longer ranges.
	320 gun.....	15			
	370 mortar..	7			
	370 howitzer.	12			
	400 howitzer.	12			
Barracks; intermediate large shelters, German type.	293 howitzer.	8	...do.....	...do.....	150 to 200 rounds according as the range is less or more than 9 kilometers.
	320 gun.....	15			
	370 mortar..	7			
	370 howitzer.	12			
	400 howitzer.	12			
Armored turrets, French type.	320 gun.....	15	..do.....	...do.....	150 rounds per target.
	370 howitzer.	12			
	400 howitzer.	12			
Armored batteries, German type.	320 gun.....	15	..do.....	...do.....	400 or 500 rounds.
	370 howitzer.	12			
	400 howitzer.	12			
Cement corridors.	[1].....	[1]	...do.....	...do.....	100 to 150 rounds per corridor.[3]
Pits.....	155 gun.....	8	[2].....	[2].....	150 rounds per pit.[3]
	240 gun.....	10			
	320 gun.....	16			

[1] All the above calibers and their corresponding ranges.
[2] Enfilade fire.
[3] Elongated or semisteel delayed action.

TABLE V.—*Estimated expenditure of ammunition for the destruction of towns.*

Kind of destruction.	Calibers.	Shells.	Fuses.	Estimated requirement per 100 square mile block of houses.
Destruction of houses.	155 howitzer; 155 gun; 220; 270.	Elongated semisteel or incendiary.	Delayed action combination fuse.	4 rounds of which ¼ with incendiary shells.
Crushing cellars...	270 mortar; 280 mortar; 293 howitzer; 370 mortar; 370 howitzer; 400 howitzer.	Semiarmor-piercing or explosive.	Delayed action base fuse.	Do.

University of California
SOUTHERN REGIONAL LIBRARY FACILITY
305 De Neve Drive - Parking Lot 17 • Box 951388
LOS ANGELES, CALIFORNIA 90095-1388
Return this material to the library from which it was borrowed.

NON-RETURNABLE
ILL - TXA
SEP 23 2003

DUE 2 WKS FROM DATE RECEIVED
OCT 22 05

UCLA YRL ILL
ILL-COD
DUE: NOV 06 2005

OC 2005
LIBRARY USE ONLY

UCLA ACCESS SERVICES
Interlibrary Loan
11630 University Research Library
Box 951575
Los Angeles, CA 90095-1575

forcements and reserves (sortie steps). (*c*) *Communication trenches*, to facilitate movement; strict policing of traffic; shelters for detached soldiers; turnouts; signs.

3. *Easy advance of reserve troops and artillery.*—Routes and itineraries reconnoitered in advance.

4. *Liaisons between the units.*—(*a*) By the judicious choice of the command posts which should be established, if possible,

near the observation stations, and with easy access to the communication trenches, in order to facilitate the movements of the liaison agents. (*b*) By the organization of liaisons by means of visual signals, wireless, airplanes, and pigeons.

5. *Supply.*—Depots for food, water, ammunition, signal flares, tools, various materials, etc.

6. *Evacuation.*—Dressing stations.

7. *Latrines.*—Constructed principally in the zone of the departure parallels, and near the assembly places.

Plan of preparation of the ground, comprising the plan of the works, the plan of execution (with the order of urgency), and the estimate of the equipment and materials to be assembled.

UC SOUTHERN REGIONAL LIBRARY FACILITY
A 000 550 149 9

Univers
Soutl
Libr